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Science, Energy and Weapons: Nuclear Ambitions of Socialist Yugoslavia 1945–1990

Abstract: The paper provides an overview of the development of nuclear research in socialist Yugoslavia from the late 1940s to the end of the 1980s. It reviews the ambitions of the state leadership in developing fundamental nuclear research, their application in energy production and the construction of nuclear power plants, as well as occasional ambitions for military applications. The development of institutions, construction of facilities, personnel training, international cooperation, internal and foreign political motives, and the role of state security bodies and the army in certain segments and periods of research are presented. An overview of the most important historiographical works, political science studies, and memoirs on this topic is also provided.

Keywords: Yugoslavia, Josip Broz Tito, Pavle Savić, nuclear scientific research, nuclear institutes, nuclear energy, nuclear power plant, nuclear weapon, proliferation

Literature and memoirs: an overview

The history of nuclear research in socialist Yugoslavia is increasingly attracting the attention of historians, historians of science, and scientists concerned with international relations and nuclear proliferation. Most research focuses on whether socialist Yugoslavia intended and was able to build an atomic bomb, and ultimately, whether it was developing a military nuclear programme. The fact that a small, economically and scientifically underdeveloped country, in difficult post-war times, developed research in nuclear sciences, raised it to a high, internationally visible level, and used it for energy production, has largely remained in the shadow of this question. Many elements are intertwined in this research problem: internal policy, foreign policy and international Cold War relations; the role of state security and espionage services; the role of the military leadership; the influence of prominent individuals, politicians, and scientists; and the processes of modernisation, industrialisation, and the development of the economy and science in the country. Research has so far produced an abundance of data, knowledge, and well-founded conclusions, serving as a barrier to unscientific generalisations, simplifications, sensationalism,

assumptions, hypotheses, and speculations, although at times it has not entirely resisted the temptations of such approaches.

In the 1960s, an official review of the development of nuclear research in Yugoslavia was published. In the late 1960s and early 1970s, testimonies from participants in these events appeared, leading to a public debate about the nature of nuclear research in Yugoslavia.[1] From the last decade of the 20th century, following the collapse of the Yugoslav state, professional and memoir literature of varying quality began to appear, focusing on certain institutions, individuals, and events from the history of nuclear research in Yugoslavia. In 1993, the recollections of Pavle Savić (1909–1994) about the early years of the Yugoslav nuclear project and the Vinča Institute were published. As a key figure in the Yugoslav nuclear programme, Savić, in addition to providing basic information on the establishment and work of the Institute, also mentioned the possibility that there were people in Yugoslavia who considered the use of nuclear energy for military purposes.[2] At the end of the decade, in 1998, a book of conversations with several associates of the Institute in Vinča (P. Savić, Milorad Mlađenović, Dušan Kanazir, Ivan Draganić, Stevan Koički, etc.) was published, in which they shared their memories of the Institute and their views on possible military ambitions.[3] In the same year, a memorial marking 50 years of the Geoinstitute – the institution responsible for locating nuclear raw materials – was published, featuring the history of the institution and the recollections of its associates.[4] In 2000, a memorial marking 50 years of work of the Institute in Vinča was published, presenting the history and analysis of its activities in various scientific disciplines.[5] Before and after that, other memories and testimonies from associates of the Institute in Vinča were published, containing information about the institute's work and an almost obligatory reference to the rumours about work on the atomic bomb.[6]

The first decade of the 21st century brought new or previously stated testimonies from several important participants in the Yugoslav nuclear programme. In 2006, Ivan Supek (1915–2007), founder and director of the "Ruđer Bošković" Insti-

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1 Slobodan Nakićenović, *Nuklearna energija u Jugoslaviji* (Beograd: Export press, 1960); Ivan Supek, „Druga revolucija", *Encyclopaedia moderna*, br. 2, 1967, 80–101, br. 3–4, 1967, 84–107; Idem, „Svjedočanstvo o jugoslavenskoj A-bombi,", *Hrvatsko sveučilište*, br. 4, 8. 4. 1971, 16, br. 5, 15. 4. 1971, 16, br. 6, 22. 4. 1971, 16; Stane Stanič, „Naša A-bomba ili mašta", *NIN*, br. 1069, 4. 7. 1971, 22–23; Idem, „Šta je istina o našoj A-bombi", *NIN*, br. 1070, 11. 7. 1971, 15–18; Idem, „Istina atomskog rašomona", *NIN*, br. 1071, 18. 7. 1971, 16–19.

2 *Казивања Павла Савића о периоду 1944–1960.* (Београд: Институт за нуклеарне науке „Винча", 1993*)*. See also: Павле Савић, *Наука и друштво. Изабрани радови. Прилози животопису* (Београд: СКЗ, 1978); Слободан В. Рибникар, „Павле Савић (1909–1994)", у: *Живот и дело српских научника*, том 5, ур. Милоје Р. Сарић (Београд: САНУ, 1999), 417–442; Dragomir Bondžić, „Rad Pavla Savića u Moskvi 1944. i 1945/46. i projekat za izgradnju jugoslovenskog instituta za fiziku", *Istorija 20. veka*, br. 2, (2015), 91–104; itd.

3 Милош Јевтић, *Разговори са Винчанцима* (Београд: Институт за нуклеарне науке „Винча", 1998).

4 *Geoinstitut. Prvih pedeset godina 1948–1998*, urednik Radule Popović (Beograd: Geoinstitut, 1998).

5 *Pola veka Instituta „Vinča" (1948–1998)*, ur. Branislava Perović-Nešković (Beograd: Institut za nuklearne nauke „Vinča", Zavod za udžbenike, 2000).

6 Milorad Ristić, „Kako sam doživljavao Vinču (1951–1966)", *Flogiston*, br. 8, (1998), 226–236; Vladimir Ajdačić „Razgovor s Miloradom Mlađenovićem", *Flogiston*, br. 12, (2002), 175–200; Milorad Ristić, „Karijera jednog inženjera", *Flogiston*, br. 13 (2003/2005), 145–173; itd.

tute in Zagreb, published a memoir in which he repeated and summarised the assessments and accusations he had made several times since the mid-1960s about the Yugoslav nuclear programme and the aspirations of certain circles to build an atomic bomb.[7] In 2008, a publication on the life and work of Anton Peterlin (1908–1993), director of the "Jožef Stefan" Institute in Ljubljana, was published, followed shortly afterwards by an article on half a century of nuclear research in Slovenia.[8] After being published in Sweden in 2009, a Zagreb edition of the memoirs of Stevan Dedijer, one of the key participants in the first phase of the Yugoslav nuclear programme, was published in 2011. In this edition, Dedijer repeated claims he had made openly since the late 1960s: that Yugoslavia was working to master the technology for producing nuclear weapons. Unlike Supek, who accused others, Dedijer claimed that the top levels of the state, as well as the entire scientific establishment, were involved in the project.[9] Similar views were expressed in 2010 by Secret Service General Jovo Kapičić, who was responsible for the project's security.[10] Croatian scientist Vladimir Knapp expressed his views in 2012, based on his memories and documents in his personal possession.[11]

A few years later, Tanja Rudež and Krunoslav Pisk published a book on the fifty years of work of the "Ruđer Bošković" Institute in Zagreb, based on interviews with the institute's founders and associates (I. Supek, Mladen Paić, Drago Grdenić, Vladimir Knapp, Ivo Šlaus, Đuro Miljanić, and others). The book provides a comprehensive collection of data, recollections, and analytical observations on the development of the institute and the formative period of nuclear research in Yugoslavia. It also addresses the issue of military nuclear ambitions, presenting differing interpretations regarding their existence, nature, and scope. Of particular scholarly significance is the inclusion, alongside testimonies related to military nuclear ambitions from the late 1940s through the 1960s, of rare assertions – put forward by political figure Božidar Matić and scientists Ivo Šlaus and Krunoslav Pisk – concerning the existence of a Yugoslav military nuclear programme during the 1980s, in which the Zagreb Institute is reported to have played a significant role.[12]

This body of memoir literature provides varying amounts and qualities of data on the issues under consideration; authors' accounts are often unreliable, generalised, or inaccurate, and are frequently shaped by attempts to justify and elevate their own roles while criticising the participation of others in the Yugoslav nuclear project. For these reasons, such testimonies must be approached with critical caution, especially

7 Ivan Supek, *Tragom duha kroz divljinu* (Zagreb: Profil, 2006). See also: *Ivan Supek 1915–2007. Spomenica preminulim akademicima*, ur. Ksenofont Ilakovac (Zagreb: HAZU, 2013); Ivan Supek, *Ivan Supek: vizije i ostvarenja, nadanja i razočaranja* (Zagreb: Tragovi prošlosti, 2025).

8 *Anton Peterlin 1908–1993: življenje in delo*, ur: Vili Bukošek, et al. (Ljubljana: SAZU, Inštitut Jožefa Stefana, 2008); Stanislav Južnič, "First Half of Century of Slovenian Nuclear Energy". https://www.academia.edu/25653537/ (accessed 22. 11. 2025).

9 Stevan Dedijer, *Špijun kojeg smo voljeli: autobiografija* (Zagreb: VBZ, 2011).

10 Tamara Nikčević, *Goli otoci Jova Kapičića* (Beograd: VBZ, 2010).

11 Vladimir Knapp, „Jugobomba – šta je istina? Prilog raspravi", *Međunarodne studije*, god. 12, br. 3/4 (2012), 133–154.

12 Tanja Rudež, Krunoslav Pisk, *Institut Ruđer Bošković. Ljudi i događaji 1950–2000* (Zagreb: Školska knjiga, 2017).

when they address political issues and the Yugoslav military nuclear programme. For a long time, memoirs and oral testimonies formed the sole basis for constructing narratives about Yugoslav nuclear research. Only later were rare archival documents and other reliable historical sources gradually uncovered and incorporated into the scholarly reconstruction of the Yugoslav nuclear programme.

Greater attention was given to this topic in the late 1990s and early 2000s.[13] During that period, one of the motives appears to have been the examination of Belgrade's alleged ability to use the legacy of the Yugoslav nuclear programme for military purposes. At the beginning of the 21st century, an American scientist specialising in nuclear proliferation issues, Jacques E. C. Hymans, focused particularly on the Yugoslav nuclear programme. He published his research on the Yugoslav programme in the prominent journal *Security Studies* (2011), and later included it in the book *Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation* (2012).[14] The characteristic of these works is the almost complete absence of archival material, reliance on memoirs and oral testimonies of participants, the author's personal insight, and rare documents, often of unknown provenance. In addition to numerous data, this literature contains many unverified claims and far-reaching conclusions about the development and purpose of the Yugoslav nuclear programme.

Towards the end of the first decade of the twenty-first century, the works of Ljubomir Petrović introduced a fundamentally new perspective. By examining the activities of the Yugoslav Society for Radiation Protection between 1963 and 1975, and briefly analysing the consequences of the 1986 Chernobyl nuclear accident, Petrović initiated the study of nuclear energy in Yugoslavia from the standpoint of environmental issues and radiation protection. This approach has remained unique within the historiography of the former Yugoslavia to the present day.[15]

Over the past decade, several historians and scholars from other academic disciplines have focused on the Yugoslav nuclear programme, either as a whole or on specific aspects, most notably its military dimension. In late 2016, Dragomir Bondžić published the monograph *Između ambicija i iluzija. Nuklearna politika Jugoslavije 1945–1990* (Between Ambitions and Illusions: Yugoslavia's Nuclear Policy, 1945–1990), which, drawing on extensive archival materials from Belgrade and other available sources and literature, provides a comprehensive overview of Yugoslav nuclear research, as well as an assessment of its scientific foundations, scope, and significance. The study traces the development of nuclear research, the search for nuclear raw

[13] Andrew Koch, "Yugoslavia's Nuclear Legacy: Should We Worry?", *The Nonproliferation Review*, vol. 4, no. 3 (1997), 123–128; William Potter, Djuro Miljanic i Ivo Slaus, "Tito's Nuclear Legacy", *Bulletin of the Atomic Scientists*, 56, 2, (2000), 63–70, https://doi.org/10.2968/056002016; Dušan Ražem, "Radiation Processing in the Former Yugoslavia 1947–1966: From 'Big Science' to 'Nulity'", *Minerva*, vol. 32, no. 3 (1994), 309–326 https://doi.org/10.1007/BF01098665; etc.

[14] Jacques E. C. Hymans, "Proliferation Implications of Civil Nuclear Cooperation", *Security Studies*, vol. 20, no. 1, (2011), 73–104 https://doi.org/10.1080/09636412.2011.549013; Jacques E. C. Hymans, *Achieving Nuclear Ambitions: Scientists, Politicians, and Proliferation* (New York: Cambridge University Press), 2012, 157–202.

[15] Ljubomir Petrović, „Kreiranje nuklearne svesti. Problemi Jugoslovenskog društva za zaštitu od zračenja 1963–1975. godine", *Istorija 20. veka*, br. 1, (2009), 123–138; Ljubomir Petrović, „Nuklearna havarija u Černobilu 1986. Prilog istraživanju ekoloških problema 20. veka", *Istorija 20. veka*, br. 2, (2010), 101–116.

materials, the establishment and enhancement of institutional, human, and technical capacities, the evolution of international cooperation, and shifting objectives across different periods – particularly the aspiration to use nuclear research for energy production and the construction of nuclear power plants. Special attention is given to the intermittent efforts of the Yugoslav leadership to harness the development of nuclear science for military purposes, examining the motives, capabilities, and outcomes of such ambitions, which, in contrast to the overall scientific achievements and scope of the programme, proved to be negligible.[16] Somewhat later, another highly significant contribution appeared with Carla Conte's study, "Yugoslav Nuclear Diplomacy between the Soviet Union and the United States in the Early and Mid-Cold War" (2019). Drawing on archival sources, the author analyses the Yugoslav nuclear programme through the lens of the leadership's diplomatic skill in acquiring nuclear technologies by exploiting Cold War rivalry and competition between the two superpowers.[17]

In the early 2020s, several doctoral dissertations were defended, and a number of studies and monographs were published that, to varying degrees and from different perspectives, address the Yugoslav nuclear programme. In 2021, Bogdan Stojanović received his doctoral degree at the Faculty of Political Sciences in Belgrade, and in the same year published a book examining the reasons why states abandon nuclear weapons programmes. In addition to a detailed theoretical analysis, the author provides empirical examples, including, among others, the case of socialist Yugoslavia.[18] In the same year, historian Marko Miljković received his doctoral degree at Central European University in Vienna and published his dissertation in Zagreb in 2025. Drawing primarily on well-known sources and literature, the author devotes particular attention to situating the Yugoslav nuclear programme within the broader international context of the Cold War and the framework of Josip Broz Tito's foreign policy, offering a range of interpretations, hypotheses, and analytical perspectives.[19] In 2024, Maja Korolija defended her doctoral dissertation at the University of Belgrade, in which she examines the Yugoslav nuclear programme from the perspectives of sociology, the history of science, and the philosophy of science.[20]

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16 Dragomir Bondžić, *Između ambicija i iluzija. Nuklearna politika Jugoslavije 1945–1990* (Beograd: Institut za savremenu istoriju, Društvo istoričara Srbije „Stojan Novaković", 2016). Second revised edition: D. Bondžić, *Između ambicija i iluzija. Nuklearna politika Jugoslavije 1945–1990* (Zagreb: FF Press, 2025).

17 Carla Konta, "Yugoslav Nuclear Diplomacy between the Soviet Union and the United States in the Early and Mid-Cold War", *Cahiers du monde russe*, vol. 60, no. 2-3 (2019), 417–440 https://doi.org/10.4000/monderusse.11239.

18 Богдан Стојановић, „Еколошка безбедност као разлог одустајања држава од програма нуклеарног наоружања", докторска дисертација, Универзитет у Београду, Факултет политичких наука, 2021; Богдан Стојановић, *Теорија денуклеаризације: зашто државе прекидају програме нуклеарног наоружања?* (Београд: Институт за међународну политику и привреду, 2021).

19 Marko Miljković, "Tito's Proliferation Puzzle: The Yugoslav Nuclear Program, 1948.–1970.", A Dissertation in History, Vienna, CEU, 2021; Marko Miljković, *Titova atomska bomba. Jugoslavenski nuklearni program 1948–1970* (Zagreb: Srednja Europa, 2025).

20 Maja N. Korolija, "Dynamics of the Relationship Between Science and Ideology and the Origins of the Nuclear Program in the Context of the Socioeconomic Transformation of the FPRY", Doctoral Dissertation, Belgrade, University of Belgrade, 2024.

In the same year, a political science study by Marina Kostić Šulejić was published, focusing on the relationship between military neutrality and the possession of nuclear weapons in Europe, as well as the options available to Serbia. Based on the existing literature, the study devotes significant attention to the historical background and the nuclear programme of socialist Yugoslavia.[21]

In addition to the key works mentioned, several authors who have studied the history of the Yugoslav nuclear programme over the past decade have published articles in journals and edited volumes, contributing to various aspects of the subject, including the search for uranium, the roles of prominent individuals and state security, international cooperation, specific events, and other related topics.[22]

In addition to this body of scholarly and memoir literature, the number of new archival sources – both Yugoslav and foreign – has gradually increased. This extensive repository of data and knowledge has become the foundation for addressing many questions about the development of Yugoslav nuclear research and for countering various speculations and sensationalist interpretations. However, the complexity and nature of the subject, the security and military background of many decisions, and the inaccessibility of key sources prevent the provision of fully reliable and definitive answers. Such answers must await the discovery of new sources. Based on the existing archival materials, memoirs, and literature, it is possible to provide a concise overview of the development and objectives of nuclear research in socialist Yugoslavia from the end of the Second World War until the dissolution of the Yugoslav state in 1990.

The first steps and the birth of ambitions 1945–1955.

Nuclear institutes

Scientific discoveries at the end of the nineteenth century and in the first half of the twentieth century revealed the phenomena of natural and artificial radioactivity and radiation, enabling an understanding of the structure of matter. Of particular significance was the discovery of fission in the late 1930s, that is, the splitting of uranium atoms and the release of large amounts of energy.[23] This development

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21 Марина Костић Шулејић, *Војна неутралност и нуклеарно оружје: између поседовања и забране: случај Европе и опције за Србију* (Београд: Институт за међународну политику и привреду, 2024).

22 Драгомир Бонџић, „Истраживање руде урана у јужној и источној Србији и Македонији након Другог светског рата“, *Лесковачки зборник,* LV, (2015), 247–259; Marko Miljković, „The Yugoslav 'Operation Paperclip': German Geologists in the Yugoslav Nuclear Program in the Late 1940s and Early 1950s“, *Godišnjak za društvenu istoriju*, 3, (2021), 7–32; Dragomir Bondžić, Martin Previšić, „Stevan Dedijer in the documents of the State Security Service from the mid-1950s to the mid-1980s“, *Istorija 20. veka*, br. 2, (2025), 439–464 https://doi.org/10.29362/ist20veka.2025.2.bon.439-464; Maja Korolija, "The Yugoslav Nuclear Program in the Context of the Cold War (1946–1971)", *Filozofski vestnik*, 46, 1, (2025), 205–236 https://doi.org/10.3986/fv.46.1.08; itd.

23 Michael F. L'Annunziata, *Radioactivity. Introduction and history* (Amsterdam: Elsevier, 2007; Jeff Hughes, "Radioactivity and Nuclear Physics", in: Mary Jo Nye (ed.), *The Cambridge History of Science. Vol. V. The Modern Physical and Mathematical Sciences* (Cambridge: Cambridge University Press 2002), 350–374; Helge Kragh, *Quantum Generations: A History of Physics in Twentieth Century* (Princeton, New Jersey: Princeton University Press, 1999); Milorad Mlađenović, *The History of Early Nuclear Physics (1896–1931)* (Singapore: World Scientific, 1998); Иван Драганић, *Кроз свет радијације и радиоак-*

enabled the production of atomic bombs and their use at the end of the Second World War in August 1945. The postwar decades were characterised by advances in nuclear science and new discoveries, the peacetime application of nuclear research for electricity generation, industry, and medicine, but above all by the nuclear arms race and the production of increasingly numerous and destructive nuclear weapons, including atomic and hydrogen bombs. The "nuclear club" expanded beyond the United States (1945) and the Soviet Union (1949), with several other countries acquiring nuclear weapons, including the United Kingdom (1953), France (1960), China (1964), and India (1974), among others. The world entered the "atomic age", which, alongside unprecedented scientific opportunities and technological development, also brought the "fear of the atom" and the threat of the use of devastating weapons with unforeseeable consequences for humanity, living ecosystems, and the planet.[24]

After the Second World War, even the small, economically and scientifically underdeveloped socialist Yugoslavia began to develop nuclear ambitions. Nuclear research was initiated in the late 1940s, based on limited material and human resources, the knowledge and authority of a small group of scientists, the enthusiasm of individuals, and the ambitions of the state leadership. Of particular importance was the authority of Pavle Savić, a prominent scientist, member of the Communist Party, and participant in the Second World War. The Party tended to exaggerate the significance of his pre-war work with Irène Joliot-Curie in Paris on experiments that contributed to the discovery of fission. After the war, Savić travelled to Moscow twice. During his second stay in 1945–46, his task was to obtain support from Soviet scientists and political authorities for the establishment of a physics institute in Yugoslavia.[25] However, apart from the transfer of knowledge and experience, these efforts produced no concrete results. The two sides had different expectations regarding cooperation in this field, and shortly afterwards, in 1948, an ideological and political conflict erupted between them, with significant consequences and the potential threat of escalation into military confrontation.

It was during this period that the first institutes for nuclear research were established in Yugoslavia. In January 1948, the Institute of Physics in Vinča was founded (later renamed the Institute for the Study of the Structure of Matter in 1950, the "Boris Kidrič" Institute of Nuclear Sciences in 1953, and the "Vinča" Institute of Nuclear Sciences in 1992). The need to expand infrastructure and promote equitable development led to the establishment of institutes in other republics. In Ljubljana, the

тивности. Сто година атомске ере (Београд: Музеј науке и технике, Геоинститут, Завод за уџбенике и наставна средства, 1996); itd.

24 Richard Rhodes, *The making of the Atomic Bomb* (New York, London: Simon & Schuster. 1986); David Holloway, *Stalin and the Bomb* (New Haven and London: Yale University Press, 1994); Volha Charnysh, *A Brief History of Nuclear Proliferation* (Santa Barbara: Nuclear Peace Foundation, 2009); Spencer R. Weart, *The Rise of nuclear fear* (Cambridge and London: Harvard University Press, 2012); J. E. C. Hymans, *Achieving Nuclear Ambitions*, 1–40; itd.

25 D. Bondžić, „Rad Pavla Savića u Moskvi 1944. i 1945/46...", 91–104; Arhiv Jugoslavije (AJ), fond Kabinet maršala Jugoslavije (KMJ) 836, II-6-a/2, Projekt izgradnje Fizičkog instituta u Beogradu, 17. 3. 1946., Pismo Pavla Savića Josipu Brozu Titu o osnivanju Fizičkog instituta u Beogradu, 17. 3. 1946. i Pismo Pjotra Kapice maršalu Josipu Brozu Titu, 13. 3. 1946; AJ, fond CK SKJ, 507, Ideološka komisija, VIII, IV/d-3-73, Pavle Savić–Mitri Mitrović, 16. 6. 1946.

Institute of Physics was founded in 1949 (renamed the "Jožef Stefan" Institute in 1952), and in 1950, the institute in Zagreb was established (renamed the "Ruđer Bošković" Institute in 1951). The creation of these institutes was encouraged by senior state official Boris Kidrič, who was responsible for planned economic development. Over time, additional research institutions were founded; laboratories were built, various instruments and devices were manufactured or acquired, and scientific and technical personnel were trained. Efforts were made to locate uranium and other nuclear raw materials, cooperation among institutes was established, partnerships with universities were developed, and international collaboration was initiated. Modern research aimed at the peaceful application of nuclear energy was launched, yielding significant results that were disproportionate to the country's economic and scientific development. Thanks to substantial state investment and expectations, expert leadership, and the dedication and enthusiasm of researchers driven by the "call of the atom and atomic energy", the institutes developed into serious scientific institutions by the mid-1950s. In Vinča, initial leadership was provided by Pavle Savić together with the French scientist of Dutch origin, Robert Walen; in Ljubljana, by Anton Peterlin; and in Zagreb, by Ivan Supek, Mladen Paić, and others. An increasing number of young researchers joined the institutes, conducting their graduate research and continuing their investigations thereafter. Material, technical, and human resources were established to support the development of various scientific disciplines. Thanks to the personal networks of Supek, Savić, Dedijer, and others, collaborations were established with countries in Western and Northern Europe, including France, the United Kingdom, Norway, Sweden, Denmark, and others. Yugoslavia hosted numerous foreign scientists, while Yugoslav researchers travelled abroad for training and conferences at international scientific centres. Upon returning, these specialists brought back knowledge and experience, continuing their work under conditions comparable to those in leading scientific institutions worldwide.[26]

By the early 1950s, despite poor initial conditions and limited material resources, the Yugoslav state had succeeded in initiating a nuclear programme and establishing its institutional, organisational, material, and human foundations. From the outset, misunderstandings, conflicts, and particular interests arose among the three institutes, yet the state leadership sought to create a unified nuclear programme under federal direction and funding. The three institutes were expected to work jointly in implementing state policies and plans in the field of nuclear science. Aware of the scale of the project and motivated by the desire to ensure the survival of their institutions and the advancement of science, institute directors accepted collaborative work and mutual cooperation in achieving the planned objectives, despite inevitable tensions and conflicts. These disputes were

[26] S. Nakićenović, *n. d.*, 1963, 17–99; *Казивања Павла Савића о периоду 1944–1960,* 10–18; M. Jevtić, *n. d.*, passim; *Pola veka Instituta „Vinča" (1948.–1998.)*, passim; S. Južnič, *op. cit.*; D. Ražem, *op. cit.*, 309–316; I. Supek, *Tragom duha kroz dvljinu*, 179–187; T. Rudež, K. Pisk, *n. d.*, 7–49; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 74–101; AJ, fond Predsedništva FNRJ, 50-82-172, Izgradnja Instituta u Vinči 1947–1950; AJ, fond Komisija za pomoć u naučnim istraživanjima (KPNI), 867-1-1, Zapisnici i zaključci sa sastanaka KPNI 1952–1955; Arhiv Slovenije (SI AS), 1961, fond Inštitut Jožef Stefan (IJS), 1-1, Pošta Borisu. Kidriču, 1948–1952.

primarily related to the allocation of funding (especially foreign currency), duplication of tasks, and the determination of goals and responsibilities, including reactor and cyclotron construction, isotope separation, uranium ore sample analysis, and the production of heavy water.[27]

Participants in the launch of nuclear research in Yugoslavia in the late 1940s and throughout the 1950s generally later described this period as a "heroic era", marked by enthusiasm, rapid development, and numerous achievements by the nuclear institutes and nuclear science, despite various challenges and obstacles. A precise assessment of the early results of the Yugoslav nuclear programme was provided by Gunnar Randers, chairman of the Norwegian Nuclear Commission, who visited Yugoslavia in 1952. He praised the skill of Yugoslav scientists and their efforts in training young specialists, noting that they had created impressive facilities and expressing amazement at how they had managed to develop such a quantity of equipment "from scratch". He observed that financial resources were the only limitation preventing Yugoslavia from further advancing its nuclear programme and reaching the high technical level of Norway's highly successful programme.[28]

Hidden ambitions

The initiation of nuclear research in post–Second World War Yugoslavia involved the highest levels of the state. Guidelines and funding were provided by state authorities, primarily the Presidency of the Government of the FNRJ, led by Josip Broz Tito, together with his closest collaborators, Edvard Kardelj and Milovan Đilas. Tito was also kept informed about Pavle Savić's activities in Moscow, where Savić sought Soviet assistance for establishing a physics institute. At the time, the First Five-Year Economic Development Plan had been launched, making the support of the Federal Planning Commission and the Economic Council of the FNRJ, led by Boris Kidrič – the main proponent of the project in its initial phase – crucial. During this phase, nuclear raw materials were particularly important, and support also came from the ministries responsible for mining, geology, and energy, headed by Svetozar Vukmanović Tempo, another prominent member of the state leadership. Such a significant project could not have been launched without the oversight of the State Security Administration (UDB), and its chief, who was also the Minister of Internal Affairs, Aleksandar Ranković, was fully informed of all activities. In accordance with the one-party system, all these figures simultaneously held positions in both the state leadership and the top echelons of the Communist Party of Yugoslavia.[29]

The initiation of nuclear research and the establishment of institutes were conducted under strict secrecy and the protection and supervision of the State Se-

[27] Arhiva Instituta „Ruđer Bošković" u Zagrebu, (AIRB), Međuinstitutski sastanci, 1951–1963; SI AS, 1961, IJS, 2-6, Korespodenca z Inštitutom Vinča; SI AS, 1961, IJS, 3-9, Korespodenca z Inštitutom „Ruđer Bošković", 1953; AJ, 867-1-1 KPNI, Zapisnici i zaključci sa sastanaka KPNI 1952–1955; Isto, Zapisnici i zaključci sa međuinstitutskih sastanaka 1952–1955; M. Miljković, *Titova atomska bomba*, 137–156.

[28] According to: J. E. C. Hymans, *Achieving Nuclear Ambitions*, 182.

[29] D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 105–106.

curity Administration (Uprava državne bezbednosti – UDB). After the founding of the Vinča Institute on 20 March 1948, the Directorate for Coordination of Work in Scientific Institutes was established under the Presidency of the Government of the FNRJ. Its director was Slobodan Nakićenović (later director of the Vinča Institute). The main tasks of the Directorate included the development of atomic physics and nuclear energy, oversight of nuclear institutes, intelligence activities to obtain scientific information and equipment, and the search for uranium ore.[30] By the early 1950s, these responsibilities were transferred to bodies responsible for geological research, and in 1952 to the Commission for Support in Scientific Research, which operated until 1955. The Commission was initially headed by Boris Kidrič and, after his death, by Svetozar Vukmanović Tempo. In addition to scientists and political officials, the Commission included a military representative, Deputy Minister of National Defence General Ivan Gošnjak, and the UDB was represented by General Jovo Kapičić.[31]

The official objectives of the work undertaken by state authorities and scientific institutes were the development of atomic physics and energy, scientific and industrial progress, the construction of a nuclear reactor ("uranium oven") for energy production, and the training of scientific personnel. However, the question arises whether the considerable efforts, financial investments, and involvement of state leadership and the secret police may also have included other, concealed military ambitions from the outset. Was there an intention to acquire the technology for producing nuclear weapons? Such a possibility was plausible in the context of Yugoslavia's conflict with the Soviet Union and the threat to the country's independence and regime survival that emerged after June 1948. Due to the lack of archival documents – particularly the inaccessibility of UDB records – precise answers cannot be provided. Nevertheless, the recollections of participants and sporadically available documents can provide certain indications.

The first information about nuclear weapons development in Yugoslavia was provided by Stevan Dedijer, a journalist, intelligence operative, and former prewar student of theoretical physics at Princeton. In the late 1960s, he claimed – repeating this assertion on several occasions – that in September 1949, Milovan Đilas and Edvard Kardelj invited him to return from New York to Yugoslavia to focus on nuclear physics and supervise Pavle Savić's work in Vinča on a Yugoslav atomic bomb. In January 1950, Dedijer arrived in Belgrade, where Kardelj allegedly told him: "We must have the nuclear bomb. We must make it even if it costs us half of our entire national income for years to come."[32] Dedijer's work in Vinča is documented in his report to the Central Committee of the Communist Party of Yugosla-

[30] AJ, 836, KMJ-II-6-a/4 (1948), Izveštaj o radu Uprave (za naučno istraživački rad) za 1948. i zadacima za 1949. – dostavljen potpredsjedniku Vlade FNRJ, Aleksandru Rankoviću (1948).

[31] AJ, 867-1-1, KPNI, I sednica KPNI, Ljubljana, 29. 7. 1952; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 106–118; *Geoinstitut. Prvih pedeset godina 1948–1998*, 48–49.

[32] S. Dedijer, *Špijun kojeg smo voljeli*, 173–184. The possibility of Yugoslavia working on an atomic bomb during this period is also mentioned by other participants, including Jovo Kapičić and Ivan Supek, as well as by Pavle Savić himself, who stated that he was pressured to develop a bomb, which he refused, asserting that he neither knew how to do so nor wished to attempt it (Т. Никчевић, *n. d.*, 161–162; I. Supek, *Tragom duha kroz divljinu*, 181–187; *Казивања Павла Савића о периоду 1944–1960,* 20).

via (CC CPY) from August 1950. In this report, he criticised Savić, the general state of the Institute, and interpersonal relations within it, concluding that work was not being carried out on the Institute's primary task, namely the construction of the reactor.[33] Similar conclusions are also found in the Vinča Institute's work diary, which Pavle Savić kept intermittently during 1950. This document contains a detailed record of a meeting held on 15 December 1950, attended by Milovan Đilas, Aleksandar Ranković, Pavle Savić, Stevan Dedijer, and Slobodan Nakićenović. The meeting revealed Savić's hesitations and his disagreements with the state leadership and representatives of the UDB. He stated openly that the purpose of the Institute should be fundamental scientific research and the training of personnel, rather than the construction of a "uranium oven". By contrast, Đilas emphasised that "the goal of the Institute is the uranium oven and the atomic bomb," which the country had to possess in order to defend itself against external threats ("among wolves, I howl"). This document is the only known source in which a party and state official explicitly articulated the production of an atomic bomb as an institutional objective.[34]

Although Savić nominally agreed at the meeting that the Institute's objective should be the construction of a reactor, he continued to delay and circumvent the implementation of this task. The state leadership remained determined to proceed with the reactor's construction, also considering its potential military applications. This objective became one of the tasks assigned to the newly established Commission for Support in Scientific Research in 1952.[35] Since it was clear that uranium was essential for conducting nuclear research for any purpose, extensive and secret explorations were undertaken to find this strategic raw material. Yugoslavia, like other parts of the world at the time, experienced a "uranium rush". The objective was to secure domestic uranium supplies regardless of the effort, cost, or economic feasibility. Field geological and mining surveys were conducted, and the possibility of extracting uranium from the ash of radioactive coal was also investigated. However, the efforts far exceeded the results achieved. The scarcity of this raw material emerged from the outset as a significant obstacle to implementing the planned nuclear policy.[36]

This was only one of the obstacles. In addition to Savić's hesitation and the lack of raw materials, other objective factors hindered the pursuit of military nuclear ambitions, including insufficient knowledge and the country's limited personnel, technical, and financial capacities. These issues were explicitly highlighted by the leadership of the Vinča Institute (Savić, Dedijer, Walen) in a memorandum addressed to the state leadership (Tito, Kardelj, Ranković, Đilas, and Vukmanović) on 25 May 1953. The memorandum was submitted during a period of liberalisation in the Yugoslav system, rapprochement with the West, and a weakening of pres-

33 SI AS, 1277, fond Edvard Kardelj, k. 88, spis 7/I-7, Stevan Dedijer – CK KPJ, 3. 8. 1950.

34 ASANU, Iz zaostavštine Pavla Savića, br. 14407/11, Dnevnik Instituta, 15. 12. 1950.

35 AJ, 867-1-1, KPNI, I sednica KPNI, 29. 7. 1952, II sednica KPNI, 6. 12. 1952.

36 AJ, 836, KMJ-II-6-a/4 (1948), Izveštaj o radu Uprave; AJ, 836, KMJ-III-2-a/22, Izveštaj Uprave za koordinaciju rada naučnih instituta, 15. 9. 1950; *Geoinstitut. Prvih pedeset godina 1948–1998*, 9–71; M. Miljković, "The Yugoslav 'Operation Paperclip', 7–32; Д. Бонџић, „Истраживање руде урана...", 247–259; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 119–135.

sure from the East; earlier that year, Stalin had died in March, followed by Boris Kidrič in April. The memorandum stated openly that "activity in atomic energy in our country began with the aim of producing atomic weapons and utilising atomic energy for economic purposes". However, it soon became clear that, under the existing economic, personnel, technical, and financial conditions, and given the available raw material and industrial capacities, such ambitions were unattainable. Only investments in the use of nuclear energy for economic and scientific purposes remained feasible, though even these were hindered by excessive secrecy, lack of knowledge, misunderstanding by the political leadership, poor organisation, and conflicts among Yugoslav institutes.[37] The Vinča Institute's independent initiative provoked strong reactions from other institutes; nevertheless, no one disputed the observation that one of the objectives of nuclear research in Yugoslavia had been the production of an atomic bomb, nor the criticism that such an objective was unachievable under the circumstances.[38]

Thus, in the late 1940s and early 1950s, the Yugoslav leadership, determined to resist external pressure and preserve the country's independence and domestic authority in the face of pressure from the Soviet Union and the Cominform countries, decided to direct the nascent nuclear research – conducted under strict secrecy and the supervision of the UDB – towards the production of nuclear weapons. The pivotal year was 1950, when state pressure intensified, while the scientific elite, particularly Pavle Savić, still lacked sufficient determination, knowledge, and willingness to shift the project from fundamental research and personnel training to the construction of a nuclear reactor and weapon production. Savić delayed, manoeuvred, and made promises he could not fulfil, yet he could not outright refuse to cooperate with the authorities, accepting various compromises in the interest of advancing science in the country. With no alternative, the state leadership relied on his expertise, which it tended to overestimate. Although it was clear from the outset that the knowledge, raw materials, personnel, technical, industrial, and financial capacities required to pursue military nuclear ambitions were insufficient, this assessment was openly communicated to the leadership only after the easing of Soviet pressure, Stalin's death, and the beginning of liberalisation in the Yugoslav system.

However, this did not mean that the project had been halted or that military ambitions had disappeared. Although the fall of Milovan Đilas from power in 1954, and Stevan Dedijer's connections to him through his brother Vladimir, led to personnel changes at the Vinča Institute (including the departure of Dedijer and Walen), research on nuclear raw materials continued that same year, along with efforts to reorganise and further develop nuclear science. The Yugoslav leadership consistently declared its commitment to the exclusively peaceful use of nuclear energy and to disarmament, yet it could not conceal its latent ambitions. In this context, the US

37 AJ, fond 837, Kabinet predsednika Republike (KPR), II-6a, P. Savić, R. Valen i S. Dedijer–Kabinetu Maršala i drugovima Kardelju, Rankoviću, Đilasu i Vukmanoviću, 25. 5.1953. „O dva bitna uslova za razvitak atomske energije kod nas".

38 AJ, 867-1-1, KPNI, IV sednica KPNI, 1. 6. 1953, Međuinstitutski sastanak, 7. 1. 1954; SI AS, 1961, IJS, 3-9, Odgovor IJS na pismo Instituta u Vinči, 18. 6. 1953; AIRB, IRB–Institut Vinča 2. 9. 1953.

ambassador in Athens in 1954 was convinced that Yugoslavia had initiated a nuclear weapons programme.[39] At the same time, the CIA had more precise information on the development of nuclear research in Yugoslavia, assessing that the existing knowledge could have enabled mastery of bomb-making technology, but that such a programme was unfeasible due to objective, primarily financial, constraints. It was considered realistic that nuclear energy in Yugoslavia would be used mainly for economic and transportation purposes.[40]

Rise and fall 1955–1970

Nuclear reactors

From the mid-1950s onwards, nuclear research in Yugoslavia became more organised and gained a more solid institutional framework. On 19 March 1955, the Federal Executive Council established the Federal Commission for Nuclear Energy (Savezna komisija za nuklearnu energiju – SKNE) as the central body responsible for formulating and implementing nuclear policy, as well as for coordinating and directing activities in nuclear sciences. The first president of the SKNE was Aleksandar Ranković, Vice President of the Federal Executive Council and State Secretary for Internal Affairs; the vice presidents were Svetozar Vukmanović and Pavle Savić, while Slobodan Nakićenović served as secretary. Among its members were General Ivan Gošnjak, Ivan Supek, Anton Peterlin, and others.[41] The establishment of the SKNE marked the end of the initial phase in the development of nuclear sciences in Yugoslavia, during which the human and material foundations for further progress were created virtually from scratch. Subsequently, this development accelerated and unfolded within the broader context of the global advancement of these scientific disciplines, a trend also evident at the First International Conference on the Peaceful Uses of Atomic Energy, held in Geneva in August 1955, in which Yugoslav representatives participated. The work of the SKNE remained strictly secret and confidential, while its declared objective continued to be the utilisation of nuclear energy for peaceful purposes.

During the 1950s, efforts to secure raw materials, train nuclear energy specialists, and expand international cooperation intensified. The primary objective was to prepare for the construction and commissioning of the country's first nuclear reactor. This task, and the nuclear project as a whole, took place within the context of Cold War international relations and Yugoslavia's position within them. Reconciliation with the Soviet Union in the mid-1950s led, among other outcomes, to the signing of the Agreement on Cooperation in the Development of Research in the Fields of Nuclear Sciences and the Peaceful Uses of Nuclear Energy in January 1956. The key result of this agreement was the "Vinča Project", under which an experimental nuclear reactor with

[39] According: W. Potter, Dj. Miljanic, i I. Slaus, *op. cit.*, 65–66; A. Koch, *op. cit.*, 123–124.

[40] CIA report. *Boris Kidric Nuclear Physics Institute at Vinca.* 24. 6. 1954. CIA-RDP80S01540R005600030049-0.https://www.cia.gov/readingroom/document/ciardp80s01540r005600030049-0 accessed 25. 11. 2025.

[41] AJ, fond Savezna komisija za nuklearnu energiju (SKNE), 177-14-40, Uredba o osnivanju SKNE, 19.3. 1955. i Zaključci i materijali I sednice SKNE, 6. 4 1955, Organizaciona šema i Pravilnik o radu; „Uredba o osnivanju Savezne komisije za nuklearnu energiju", *Službeni list FNRJ*, br. 13, 23. 3. 1955, 167.

a capacity of 6–10 megawatts was commissioned at the Vinča Institute on 28 December 1959.[42] In the meantime, a zero-power training nuclear reactor was constructed at Vinča and began operation in May 1958. However, this achievement was overshadowed by the nuclear accident on 15 October 1958, in which six individuals were severely exposed to radiation. Treatment took place at the Curie Hospital in Paris, where one person died. This accident had significant consequences for the subsequent development of Yugoslav nuclear research, including personnel changes and increased attention to radiation protection.[43]

International cooperation played a significant role in the "Vinča Project" and in the development of nuclear institutes and research during the 1950s. Yugoslavia leveraged the rivalry between the great powers and its position in a Cold War–divided world to obtain nuclear technology from both sides of the Iron Curtain on favourable terms, thereby accelerating technological development in nuclear sciences.[44] Yugoslavia was visited by nuclear experts from various countries, while young scientists from Yugoslav institutes travelled abroad for specialised training and to attend scientific conferences at major nuclear research centres worldwide. In addition to cooperation with the Soviet Union, the United States, and Western European countries, increasingly intensive collaboration was gradually developed with countries of the Third World. From the outset, Yugoslavia participated in the work of international organisations, including the International Atomic Energy Agency (IAEA) and the Conseil Européen pour la Recherche Nucléaire (CERN). Yugoslavia was involved in the transfer of knowledge in the field of nuclear sciences: it signed numerous bilateral agreements, took part in international scientific projects, and acquired various instruments, technologies, and scientific literature. However, the results and scope of this cooperation varied and were not always satisfactory. Alongside many positive outcomes, extensive international networks also had negative effects, most notably the phenomenon of "brain drain", reflected in the permanent emigration of nuclear specialists, which became increasingly pronounced from the 1960s onward.[45]

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42 Драгомир Бонџић, „Сарадња Југославије и СССР-а у области нуклеарне енергије 1 1955–1965", *Српско-руски односи од почетка 18. до краја 20. века*, ур. Михаило Војводић (Београд: САНУ, 2011), 317– 331; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 186–200; M. Miljković, *Titova atomska bomba*, 249–300; AJ, 177-437-1564, Sporazum FNRJ i SSSR o saradnji na razvoju istraživanja u područjima nuklearnih nauka i korištenju nuklearne energije u mirnodopske svrhe, 28. 1. 1956; AJ, 177-2-2, Projekt Vinča.

43 See more in: AJ , 177-4-9, Akcident u Vinči 1958–1960; Milan Pešić, "Estimation of Doses Received by the Operators in the 1958 RB Reactor Accident Using the MCNP5 Computer Code Estimation", *Nuclear Technology & Radiation Protection*, vol. 27, no. 3, (2012), pp. 199–221; Драгомир Бонџић, „Лечење сарадника Института „Борис Кидрич" у Винчи озрачених у акциденту 15. октобра 1958", у: *Историја медицине, фармације, ветерине и народна здравствена култура*, књ. 4, ур. Надежда Педовић (Зајечар: Историјски архив, 2013), 247–256; Marko Miljković, "Nuclear Yutopia: The Outcome of the First Nuclear Accident in Yugoslavia 1958", in: *Labor in State-Socialist Europe 1945-1989, Contributions to a History of Work*, ed. Marsha Siefert (Budapest-New York, CEU Press, 2020), 274–305.

44 C. Konta, *op. cit*, 417–440; M. Miljković, *Titova atomska bomba*, 217–270.

45 S. Nakićenović, *n. d.*, 95–104; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 242–271; J. E. C., Hymans, "Proliferation Implications of Civil Nuclear Cooperation", 75–93; AJ, 177-15-50, Sednica SKNE, 1. 7. 1959, Pregled međunarodne saradnje naše zemlje na području nuklearne energije, 1959.

Power plant plans and bomb dreams

The Federal Commission for Nuclear Energy worked on preparing a long-term development plan, setting priorities, and providing strategic guidance for research in nuclear energy. During this process, disagreements arose in the late 1950s between scientists and the political and managerial elite. After extensive debates and analyses, it was decided to redirect nuclear research in the country towards the development of the energy sector and nuclear technology, with the ultimate aim of constructing a nuclear power plant. The goal was for nuclear energy to complement hydroelectric and thermal power in the coming decades. Proponents of fundamental research, technological familiarisation, and specialist training were sidelined; among them were the initiators and leading figures of the nuclear project, Pavle Savić and Ivan Supek, who soon withdrew from it. The new developmental direction was to involve domestic industry and the broader economy, particularly the electric power sector. International cooperation was essential, and negotiations were therefore held with foreign countries and international organisations. Consideration was given to the type and capacity of the power plant, the construction site, and its cost. Some long-term plans proposed building as many as twelve nuclear power plants in Yugoslavia over the following decades.[46]

This strategic orientation was adopted despite early and repeated warnings that Yugoslavia's financial resources were limited, that the discovered raw material reserves were energetically almost negligible, and that the country lacked sufficient human, technological, and industrial capacity to achieve the desired results. Alongside expectations of foreign assistance, the search for nuclear raw materials within the country was intensified, in the hope that sufficient reserves would be discovered and that Yugoslavia would be able to exploit them independently on an industrial scale. Particular hopes were placed in the Kalna mine on Stara Planina, where a semi-industrial facility for uranium processing and the production of uranium ore concentrate ("yellowcake") was established in the early 1960s. However, the reserves quickly proved insufficient and production economically unviable, and Kalna ceased operations as early as 1965.[47]

However, it appears that uranium was not sought solely for constructing a nuclear power plant. In the late 1950s and early 1960s, amid a complex international environment marked by intensifying Cold War tensions, clandestine plans, studies, and considerations regarding the possibility of producing nuclear weapons resurfaced in Yugoslavia. According to available documents, this possibility was mentioned in military and expert reports, long-term development plans, the *Information on the Possibility of Producing Nuclear Weapons in Small Quantities* from May 1961, and discus-

46 AJ, 177-14-47, Sednica SKNE 28. 6. 1958. Izveštaj stručne komisije za izradu „Opštih smernica perspektivnog plana razvoja nuklearnih reaktora", februar 1958; AJ, 177-24-94, Sednica Stručnog veća SKNE, 12–13. 11. 1959; AJ, 177-17-58, Sednica SKNE, 10. 5. 1962; AJ, 177-17-59, Sednica SKNE 1. 10. 1962.

47 *Geoinstitut. Prvih pedeset godina 1948–1998*, 13–76; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 226–241; M. Miljković, *Titova atomska bomba*, 336–353; AJ, 177-13-34, Informacija o Kalni, 11. 6. 1965; AJ, 177-1-1, Informacija o rudniku urana Kalna, 10. 11. 1965; AJ, 177-20-78, Sednica SKNE, 27. 6. 1966; AJ, 177-13-34, Zapisnik Likvidacione komisije Kalne, 29. 6. 1971.

sions on the long-term development plan in May 1962. At the same time, diplomatic initiatives for disarmament and the establishment of nuclear-weapon-free zones (the Rapacki Plan), which Yugoslavia supported, emerged, and the policy of non-alignment was being shaped with Yugoslavia's direct participation. All of this undoubtedly influenced the attitude of the Yugoslav leadership towards the potential launch of a military nuclear programme. The aforementioned documents concluded that the production of nuclear weapons was not feasible in Yugoslavia at that time, due to a lack of financial, industrial, and scientific capacity, as well as insufficient raw materials and qualified personnel. Moreover, the political leadership lacked a clearly defined and firm will to initiate such a project at a time when the Non-Aligned Movement was being formed and Yugoslavia was actively engaged in promoting peace and global disarmament. Nevertheless, analyses and plans were drawn up outlining possible steps, options, key challenges, the involvement of the domestic economy, and projected costs, should a decision be made in the future to pursue this path. All such analyses stopped at assessing the possibility of obtaining nuclear explosive material, without addressing subsequent stages such as weapon design, testing, or delivery systems.[48]

In addition, in the early 1960s, certain activities were observed that could have led to the military use of nuclear research. Efforts to construct facilities for uranium extraction from the Kalna mine were intensified; proposals in long-term development plans considered acquiring a high-power reactor; and, through international cooperation, steps were taken to master certain sensitive technologies and to build facilities for reprocessing irradiated fuel and extracting plutonium suitable for weapons production. However, as noted above, uranium reserves at Kalna quickly proved insufficient and the facility economically unviable; the objectives of the long-term plans were subsequently revised; and activities aimed at mastering sensitive technologies were soon discontinued, remained at a low technological level, and produced no results – certainly none that could have had military applications. Nevertheless, as a consequence of these activities and internal plans in the early 1960s, doubts and resistance emerged among scientists regarding the redirection of nuclear research towards military objectives, followed by intense debates over the existence of Yugoslavia's nuclear military ambitions.[49]

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48 Vojni arhiv (VA), ABHO JNA, 443-10-6, Plan naučnoistraživačkih radova iz područja nuklearne energetike za potrebe opštenarodne odbrane za 1958. i Perspektivni program naučnoistraživačkih radova u oblasti nuklearne energije za potrebe narodne odbrane, str. pov. 72, 11. 1. 1958; AJ, 177-14-47, Zapisnik i materijal sa sastanka SKNE 28. 6. 1958, Izveštaj stručne komisije za izradu „Opštih smernica perspektivnog plana razvoja nuklearnih reaktora", februar 1958; AJ, 177-1-1, Prilog perspektivnom programu naučno-istraživačkih i drugih radova u oblasti nuklearne energije za potrebe odbrane zemlje /odeljak: atomsko oružje/, str. pov. 4, 1958; AJ, 177-1-1, Poziv na sastanak, 22. 5. 1961. i „Informacija o mogućnosti proizvodnje nuklearnog oružja u malim količinama", 1961; AJ, 177-17-58, Sednica SKNE 10. 5. 1962.

49 D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 360–392; M. Miljković, *Titova atomska bomba*, 363–404; J. E. C., Hymans, "Proliferation Implications of Civil Nuclear Cooperation", 86–87; W. Potter, Dj. Miljanic, i I. Slaus, *op. cit.*, 66; Andrew Koch, *op. cit.,* 124; I. Supek, „Svjedočanstvo o jugoslavenskoj A bombi, 3, Šutnja", *Hrvatsko sveučilište*, br. 6, 22. IV 1971, 16. CIA reports left no doubt: the Yugoslav nuclear programme was "modest", research-oriented, and aimed at peaceful purposes. It depended on foreign assistance, and there was neither the capacity to produce

From "big science" to "nullity"

By the early 1960s, Yugoslavia's military nuclear ambitions and illusions had largely vanished. At the same time, the country's overall peaceful nuclear programme was faltering. Lacking guarantees of rapid and reliable results, and faced with the impossibility of achieving unrealistic goals, the state leadership lost interest in costly research, steadily reducing investment in nuclear institutes throughout the decade. Only applied research and the development of nuclear energy remained of interest. Moreover, the project suffered from inherent weaknesses from the outset: it was poorly managed, lacked clear objectives, and inter-institutional conflicts rendered it inefficient. Its position was further undermined by the "brain drain", which intensified during the 1960s. Simultaneously, the state entered a deep political, social, and economic crisis that worsened throughout the decade. Conflicts within the federal leadership and between republican and national elites culminated in the defeat of proponents of centralism and a strong federal state. The country became increasingly decentralised and weakened, conditions unfavourable for a costly and complex nuclear project. Over time, financial allocations to nuclear institutes were reduced; these institutes were transferred to republican budgets and directed towards cooperation with industrial enterprises and market-oriented activities.

The fall of Aleksandar Ranković from power in 1966 marked the weakening of the federal UDB/SDB, which had previously overseen nuclear research. From that point, the Federal Commission for Nuclear Energy gradually lost authority and significance, ultimately being dissolved in 1971 along with several other federal bodies. The project thus evolved from initial enthusiasm and the attempt to build "big science" towards stagnation and decline. At the same time, developments in the international arena and détente in the Cold War contributed to the waning of state interest in nuclear investments. Yugoslavia increasingly relied on its role in the Non-Aligned Movement and in advocating peace and disarmament. In 1968, it signed the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), adopted that year, and ratified it in 1970, coinciding with the dissolution of the SKNE and the cessation of nuclear research.[50]

nuclear weapons nor any plans to undertake efforts in this area. (CIA report (1958). *The Yugoslav Atomic Energy Program*. Approved for Release: September 27, 2017: 06629854. Retrieved from (https://www.cia.gov/readingroom/document/06629854); CIA report (1973). *National Intelligence Survey 21; Yugoslavia; Science*. Approved for release: June 16, 2009: CIA-RDP01-00707R000200100038-4. Retrieved from (https://www.cia.gov/readingroom/document/cia-rdp01-00707r000200100038-4) (Accessed 21. 11. 2025).

50 D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 272–300; M. Miljković, *Titova atomska bomba*, 431–460; J. C. E. Hymans, *Achieving Nuclear Ambitions,* 172–202; D. Ražem, *op. cit.*, 309–326; Diplomatski arhiv Ministarstva spoljnih poslova Srbije (DA MSP), Politička arhiva (PA), OUN, 1968, f. 222, f. 4, sign. 422700, Informacija o potpisivanju Ugovora o neširenju nuklearnog oružja, 25. 6. 1968, 12. 7. 1968; „Zakon o ratifikaciji Ugovora o neširenju nuklearnog oružja", *Službeni list SFRJ* , br. 10, 5. 3. 1970, 313–318; AJ, 177-2-2, Predlog novog delokruga SKNE, 4. 2. 1971.

Restoration and the end 1974–1990

Reawakening of ambitions

However, it appears that Yugoslavia's military nuclear ambitions did not disappear with the fall of Aleksandar Ranković, the weakening of the State Security Service, the decentralisation of the state, or the dissolution of the SKNE. They resurfaced in the mid-1970s, prompted by India's nuclear test, "Smiling Buddha", on 18 May 1974. As a close ally and one of the leading states of the Non-Aligned Movement had acquired the technology to produce nuclear weapons, the Yugoslav leadership – despite its strong commitment to disarmament and the 1970 ratification of the NPT – renewed its interest in nuclear research.[51]

In July 1974, Josip Broz Tito convened representatives of the state leadership, the Army, and nuclear institutes, requesting that they examine the possibility of Yugoslavia renewing nuclear research and producing nuclear weapons. In October 1974, the Federal Secretariat for National Defence produced a document entitled "On the Development of Nuclear Energy in Yugoslavia: A Preliminary Assessment of the Requirements and Feasibility of Implementing Nuclear Weapons" (the so-called "Kozara Task"). This document presented the knowledge of Yugoslav scientists and military experts regarding the military-political aspects of nuclear armament, the technology of nuclear weapons production, and the necessity and feasibility of Yugoslavia developing a military nuclear programme, either independently or alongside a nuclear energy programme. The stated objective was "to develop tactical nuclear weapons for the needs of our armed forces". The document identified organisational, financial, economic, personnel, political, and other obstacles to launching such a project. It also expressed expectations that non-aligned countries – primarily India – would provide assistance. At the same time, a separate document was produced focusing exclusively on the development of nuclear technology for peaceful energy purposes.[52]

These materials were reviewed multiple times at the highest levels of state leadership, including during sessions of the Presidency of the SFRY on 4 December 1974, 10 January 1975, and 11 July 1975. A decision was to be made regarding one of the proposed models for the development of nuclear energy and the possible integration of a military programme. In these dynamic discussions, beyond the general desire to resume nuclear research, the difficulties quickly became apparent, particularly concerning military plans. Material, financial, and personnel deficiencies were already well known and noted in the documents. These challenges were exacerbated following the discontinuation of the earlier project, due to

[51] Dragomir Bondžić, „Indijska nuklearna proba 1974–odjeci u Jugoslaviji", *Istorija 20. veka*, br. 1, (2016), 139–150; DA MSP, PA, Indija, 1974, f. 49, dosije 21, 426183, Informacija o reagovanju u svetu na indijsku nuklearnu eksploziju, 29. 5. 1974.

[52] D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 403–418; W. Potter, Dj. Miljanic, I. Slaus, *op. cit.,* 63–70; AJ, fond Predsedništvo SFRJ, 803-21, „O razvoju nuklearne tehnologije u Jugoslaviji. Prethodna procena potreba i mogućnosti realizacije nuklearnog oružja", „Zadatak Kozara", str. pov. državna tajna, oktobar 1974; AJ, 803-22, „Procena potreba i mogućnosti jedinstvenog programa nuklearne energije u SFRJ", decembar 1974.

the dispersal of existing resources and experts, neglect of research and knowledge, equipment obsolescence, and personnel retraining. Uranium and financial resources remained insufficient, and scientific and industrial capacities were inadequate. Solutions were sought through strengthening scientific research, cooperation with universities, development of domestic industry, international collaboration, and the use of licences and foreign expertise. However, new challenges also emerged. The key obstacles were systemic, political, and organisational, resulting from the weakening and fragmentation of the Yugoslav federation under the 1974 Constitution, the autonomy of republican centres, the implementation of the principles of self-management and "associated labour", and the requirement for consensus among republics and provinces on all matters. Resistance to the resumption of research quickly appeared, fuelled by fear of a "return to the old ways" – namely, the revival of the old SKNE and its secretive, centralised, and directive style of operation. All this complicated the initiation of a complex, costly, and, in the military segment, clandestine nuclear programme. Moreover, expectations of assistance from friendly countries (India and other non-aligned states) proved overly optimistic. A visit by experts to India, Egypt, and Indonesia in January 1975 demonstrated that external support could not be relied upon. International relations more broadly, Yugoslavia's position in the Non-Aligned Movement, and its participation in the NPT further complicated the leadership's decision to restart a military nuclear programme.[53]

Big plans and the collapse

The peaceful segment of the programme envisaged the construction of 20 nuclear power plants in Yugoslavia by 2000—including the already initiated Krško plant – to meet the country's electricity needs alongside thermal and hydroelectric capacities, while also fostering the development of science, industry, and the economy, and keeping pace with global standards in these fields. This segment was less sensitive than the military one, but it too was fraught with numerous uncertainties, primarily regarding the potential integration of a military programme. The initiation of the programme required the re-establishment of a central authority to oversee nuclear research at the federal level, a matter sensitive due to previous experiences with the SKNE. After extensive discussions and agreements, the Commission for Nuclear Energy of the Federal Executive Council was established in 1976 as a provisional body, and in 1978 as a permanent institution with a dedicated Subcommission for Ongoing Issues. The military segment of the programme was completely abandoned, so the Commission focused on the development and coordination of nuclear research, its applications in energy and technology, legal and regulatory frameworks, the search for raw materials,

[53] AJ, 803-21, Stenografske beleške sa sednice Predsedništva SFRJ, 4. 12. 1974; AJ, 803-22, Stenografske beleške sa sednice Predsedništva SFRJ, 10. 1. 1975; AJ, fond Savezni komitet za nauku i kulturu, 320-8-13, Izveštaj jugoslovenske delegacije za ispitivanje mogućnosti saradnje s Indijom u području primjene nuklearne energije 9–20. 1. 1975, 19. 2. 1975; AJ, 803-28, Teze za organizaciju federacije u oblasti nuklearne energetike i razvoja tehnologije, državna tajna, materijal za sednicu Predsjedništva SFRJ, 11. 7. 1975; Isto, Stenografske beleške sa sednice Predsedništva SFRJ, 11. 7. 1975.

radiation protection, personnel training, international cooperation, and technology transfer, among other areas.[54]

In the following period, various results were achieved in research, the application of radioisotopes, collaboration between institutes and industrial enterprises, international cooperation, exploration of raw materials, and the development of a nuclear energy programme. The most significant achievement was the Krško Nuclear Power Plant, whose construction was initiated in 1974 by the republics of Slovenia and Croatia in cooperation with the American company Westinghouse, and which was connected to the national power grid in 1981. This plant was intended to be the first in a series of nuclear power stations in the country, with further construction planned throughout the 1980s. However, events unfolded differently, both with respect to the nuclear programme and the state itself.[55]

It is certain that the Commission for Nuclear Energy of the Federal Executive Council did not undertake any efforts to use nuclear research for military purposes, although this was one of the scenarios considered in the 1974 documents. Some believe that a military programme (Programme A) was initiated in the 1970s, intensified after Tito's death, and operated in strict secrecy under Army leadership, running parallel to the civil nuclear programme (Programme B) from 1982 to 1988. However, no archival documents confirming the existence of such a programme have been found. Currently, information is limited to a few testimonies from politicians and scientists involved in these events (including Božidar Matić, Ivo Šlaus, Đuro Miljanić, Krunoslav Pisk, and others), based on their recollections.[56]

Although some of these activities could be interpreted as preparations for the production of nuclear weapons, this possibility is contradicted by the broader circumstances of the Yugoslav state, economy, and society during the final decade of its existence. In the 1980s, the political and economic crisis reached its peak, inter-republic and inter-ethnic conflicts were constant, the self-management system proved ineffective, the state faced imminent bankruptcy, was unable to find solutions to overcome the crisis, and was moving towards disintegration. Under these conditions, organising and financing a complex, costly, and secret military nuclear programme would have been extremely difficult. From the early 1980s, an anti-nuclear movement emerged in Yugoslavia, opposing the construction of nuclear power plants and the entire civil nuclear programme. This movement culminated after the Chernobyl nuclear disaster in 1986 and halted the country's nuclear energy development through the adoption of a moratorium and the *Law on the Prohibition of Nuclear Power Plant Construction in the SFRY* in June 1989. These developments decisively af-

54 AJ, 130-2925, I sednica Komisije SIV-a za nuklearnu energiju, 15. 3. 1976; AJ, fond SIV, 130-3779, Zapisnik sa sastanka Komisije SIV-a za nuklearnu energiju, 14. 4. 1978. i Organizacija vršenja poslova nuklearne energije u okviru prava i dužnosti federacije, 21. 2. 1978.

55 AJ, 130-9540, Sednica Komisije SIV-a za nuklearnu energiju, 23. 4. 1984, Informacija o završetku izgradnje i puštanju u pogon Nuklearne elektrane Krško; „Dogovor o osnovama dugoročnog plana Jugoslavije za razvoj i primenu nuklearne energije u energetici do 2000", *Službeni list SFRJ*, br. 18, 2. 4. 1982, 476–485; D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 473–481.

56 W. Potter, Dj. Miljanic, i I. Slaus, *op. cit.*, 63–70; A. Koch, *op. cit.*, 124–126; J. Hymans, *Achieving Nuclear Ambitions*, 184, 197; T. Rudež, K. Pisk, *n. d.,* 129–144.

fected the cessation of any military nuclear programme, if it indeed existed. Given the prevailing conditions, its objectives were clearly illusory, and its achievements and results negligible.[57] Like its nuclear ambitions, the Yugoslav state itself soon disappeared from the historical stage.

Conclusion – objectives, achievements and legacy

The nuclear project initiated in Yugoslavia after the Second World War continued until the state's dissolution, characterised by periods of progress and decline, as well as shifting objectives and outcomes. It was an attempt to establish "big science" on the periphery, within a poor, economically and scientifically underdeveloped society governed by a one-party totalitarian regime. Its legacy includes one nuclear power plant; several nuclear institutes and university departments; various reactors, facilities, and a wide range of instruments and equipment; generations of scientists and experts who remained in the country and those who went abroad, along with their scholarly contributions; challenges related to facility maintenance, environmental contamination, and the development of ecological awareness; numerous realised and unrealised ambitions; and a multitude of unresolved questions. The largest number of questions – and the least reliable historical evidence – concern the military nuclear programme: its advocates and opponents, trajectories and dead ends, grand plans and ambitions, and modest achievements and results. Ambitions to produce nuclear weapons arose several times within the state leadership, reflected in drafts and plans for nuclear policy. Whether these ambitions were a genuine "megalomaniacal idea" or a calculated "diplomatic bluff', they arose from the leadership's perceived need to preserve independence, strengthen security, deter potential adversaries, consolidate political authority through military and propaganda means, and position Yugoslavia more firmly within Cold War international relations.

The first indications of aspirations to produce an atomic bomb in Yugoslavia date to the late 1940s, when protection against the Soviet Union seemed necessary. Similar intentions resurfaced in the late 1950s but faded with the weakening of the state, decentralisation, escalation political and economic crises, and the general stagnation of nuclear research during the 1960s. They re-emerged after India's nuclear test in 1974 and may have persisted until the late 1980s. Regardless of whether any actor in Yugoslavia genuinely sought to produce an atomic bomb, or whether such a political decision was ever formally made, it was clear from the outset that the country lacked the financial, scientific, industrial, technical, material, and human resources required to do so. Nor was there a firm and sustained will on the part of the political leadership – and even less so among scientists – to engage in such costly, complex, and morally contentious endeavours.

The positions of the political leadership fluctuated in line with Cold War international dynamics and depended on the development of the Non-Aligned Mo-

[57] D. Bondžić, *Između ambicija i iluzija*, 2. izdanje, 468–473; Lj. Petrović, „Nuklearna havarija u Černobilu 1986, 101–116; „Zakon o zabrani izgradnje nuklearnih elektrana u SFRJ", *Službeni list FNRJ*, br. 35, 16. 6. 1989, 892.

vement and relations among the great powers. They were also shaped by domestic conditions: decentralisation, the weakening of the federation, inter-republic and inter-ethnic conflicts, the evolution of the self-management system, and the deepening political and economic crisis that ultimately led the country towards collapse. Under such circumstances, neither an efficient nor a successful complex and costly nuclear programme – particularly one with military ambitions – was feasible. The measures undertaken that, alongside peaceful applications, might have had potential military relevance remained at such a low technological level and produced such limited results that it can be concluded they never led towards mastering the production of nuclear weapons.

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Science, Energy and Weapons: Nuclear Ambitions of Socialist Yugoslavia 1945–1990

Summary: The nuclear project initiated in Yugoslavia after the Second World War continued until the end of the state, marked by periods of progress and decline, with varying objectives and outcomes. It was an attempt to establish "big science" on the periphery, under the conditions of a poor, economically and scientifically underdeveloped society and a one-party totalitarian state. The least reliable historical evidence concerns the military nuclear programme. Ambitions to produce nuclear weapons emerged several times within the state leadership. Whether these ambitions reflected a genuine "megalomaniacal idea" or a calculated "diplomatic bluff", they were driven by the leadership's perceived need to preserve independence, strengthen security, deter potential adversaries, consolidate political, military, and propaganda authority, and secure a stronger position in Cold War international relations.

The first signs of military nuclear ambitions emerged in the late 1940s, during a period of acute tension and perceived threat from the Soviet Union. Later plans to produce nuclear weapons were considered in the late 1950s and early 1960s, but were abandoned during that decade amid state decentralisation and intensifying political and economic crises. These ambitions briefly resurfaced in the mid-1970s, yet there is no reliable evidence that they were pursued in practice, either then or during the 1980s. In any case, it was clear that Yugoslavia lacked the financial, scientific, industrial, technical, material, and human resources necessary to conduct a serious and effective military nuclear programme. The general social, political, foreign policy, economic, and scientific conditions required for such a project were also absent in a state that was gradually weakening and steadily approaching dissolution.

Keywords: Yugoslavia, Josip Broz Tito, Pavle Savić, nuclear scientific research, nuclear institutes, nuclear energy, nuclear power plant, nuclear weapon, proliferation